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Evaluation

# The School Nutrition Dietary Assessment Study

## School Food Service, Meals Offered, and Dietary Intakes

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**THE SCHOOL NUTRITION  
DIETARY ASSESSMENT STUDY:  
SCHOOL FOOD SERVICE, MEALS OFFERED,  
AND DIETARY INTAKES**

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Project Director

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## EXECUTIVE SUMMARY

This report on the findings of the School Nutrition Dietary Assessment study presents information on the National School Lunch Program (NSLP) and the School Breakfast Program (SBP), on the nutrient content of school lunches and school breakfasts as offered to students, and on the characteristics and dietary intakes of program participants. A companion report presents a comparison of the intakes of participants and nonparticipants.

The School Nutrition Dietary Assessment study collected information from nationally representative samples of 545 schools and 3,350 students from 329 of the schools. Each school provided information on all foods and beverages offered as part of an NSLP or SBP meal during a one-week period between January and May 1992. Each student provided information on all foods and beverages consumed during a 24-hour period that included a school day.

### THE NATIONAL SCHOOL LUNCH PROGRAM

**Almost all public schools participate in the NSLP.** Almost 99 percent of public schools and 83 percent of all public and private schools combined participate in the NSLP. Only a small fraction of schools do not offer either the NSLP lunch or a non-USDA lunch program.

The average full price for a school lunch during the 1991-1992 school year was \$1.14, with averages ranging from \$1.11 in elementary schools to approximately \$1.22 in middle and high schools. The average price of a reduced-price meal was \$0.38, with no variation across grade levels. Slightly less than 40 percent of the school lunches were free meals, 7 percent were reduced-price meals, and 53 percent were full-price meals.

**Students have a variety of lunch options in addition to the NSLP.** A lunch brought from home is the most prevalent non-NSLP lunch choice. Outside schools, lunches at home and at restaurants are the two most prevalent options. Inside schools, vending machines, school stores, and snack bars are available. High schools are more likely than either middle or elementary schools to allow students to eat at restaurants and to offer food from vending machines or school stores.

In addition to an NSLP meal, more than one-half of the school cafeterias offer some foods that can be purchased separately (a la carte). This type of arrangement is much more prevalent in middle and high schools than in elementary schools. Baked goods (such as cookies and cakes), beverages, frozen desserts, and snack foods are the most commonly offered a la carte items. However, nearly 40 percent of high schools participating in the NSLP offer at least one a la carte entree. Pizza, cold cut sandwiches, and hamburgers are the a la carte entrees offered most often.

**The NSLP is available to 92 percent of all students in the country.** On a typical school day, 56 percent of those to whom it is available participate. Some groups of students participate more than do others. Participation varies with household income, age, gender, and region. More elementary school students than middle school and high school students take part in the program. Students who are certified for free or reduced-price meals are more likely to obtain an NSLP lunch (although not all do so) than are students who are not certified and thus pay full price. More students participate where the full price is lower, and more boys than girls participate. More students in rural schools participate than in urban and suburban schools. Furthermore, students in the Southeast, Southwest, and Mountain states are more likely to participate are than students in the

Northeast and West. An open-campus policy allowing students to leave school at lunchtime tends to reduce NSLP participation.

**Schools offer a variety of food choices under the NSLP.** The NSLP meal-pattern requires that every lunch offer one serving each of meat, grains, and milk, and two servings of vegetables and/or fruits. In addition, schools are encouraged to offer a variety of food choices and the opportunity to vary caloric intake.

Slightly more than one-half of all school menus offer a choice of entree each day, 35 percent offer two or three entrees, and 8 percent offer six or more. A large number of choices at lunch is more prevalent in high schools and middle schools than in elementary schools.

Schools also offer food variety and the opportunity to vary caloric intake by providing self-serve food bars, usually salad bars. About one-half of high schools and 16 percent of elementary schools offer a food bar at least once per week; many do so more frequently. Salad bars offer an average of two entree choices, seven vegetable/fruit choices, and one bread/bread alternate choice, as well as salad toppings and dressings.

Schools must offer both whole milk and one type of low-fat unflavored milk. Most schools also offer one other type, usually chocolate milk. About one-fourth offer four types of milk. Although desserts are not required, 39 percent of lunch menus offer dessert.

**NSLP lunches provide one-third or more of the Recommended Dietary Allowances (RDA) for key nutrients.** In elementary, middle, and high schools, the amount of most nutrients in the average NSLP meal exceeds the RDA standard of one-third of the daily RDA for the age groups at each school level. However, in the following cases, school lunches provide less than of one-third of the RDA: zinc, for most age groups; iron, for 11- to 18-year-old females; and food energy, vitamin B6, and magnesium, for 15- to 18-year-old males.

**The levels of fat and saturated fat in NSLP lunches offered exceed the Dietary Guideline goals. The level of sodium exceeds National Research Council (NRC) recommendations, but the average level of cholesterol is within the recommended range.** The average percentage of food energy from total fat in NSLP lunches is 38 percent, compared with the Dietary Guideline goal of 30 percent or less; the percentage from saturated fat is 15 percent, compared with the Dietary Guideline goal of less than 10 percent. NSLP lunches provide an average of 1,479 mg of sodium, which is nearly two-thirds the NRC recommendation of 2,400 mg or less per day and is nearly twice the lunch target of 800 mg or less. The average amount of cholesterol in lunches offered is 88 mg, which is less than one-third of the recommended maximum daily intake of 300 mg.

**Virtually no schools meet the Dietary Guideline goals for fat and saturated fat.** Only 1 percent of schools offer lunches that provide an average of 30 percent or less of food energy from fat. In only one school in the sample did the weekly lunch menu offerings provide an average of less than 10 percent of food energy from saturated fat.

**Some schools offer at least one low-fat lunch.** In 44 percent of schools, students can select at least one NSLP lunch with the five meal components that meets the goal of 30 percent or less of food energy from fat. These low-fat lunches provide less food energy than the average lunches and provide less than one-third of the RDA for food energy, but contain similar amounts of protein, vitamins, and minerals. In 56 percent of schools, students cannot select an NSLP lunch with the five meal components that provides 30 percent or less of food energy from fat.

**Schools in which average NSLP lunches come close to meeting the Dietary Guideline goal for total fat follow several menu-planning, food-purchasing, and food-preparation practices to reduce the fat content of the lunches.** Compared with schools providing higher-fat lunches, schools providing lunches with a relatively low average percentage of food energy from fat (less than 32 percent) typically:

- Offer ground-beef entrees less often and offer poultry and meatless entrees more often
- Offer an extra bread item in addition to the bread or bread alternate included in an entree (for example, bread plus rice or spaghetti)
- Offer vegetables with added fat less often (particularly deep-fried french fries)
- Offer fruit and fruit juice more often and offer juice in addition to other items meeting the vegetable and fruit requirements of the meal-pattern
- Offer 2-percent milk less frequently and offer 1-percent milk or nonfat milk more frequently
- Offer salad dressing less frequently, but offer low-calorie dressing more frequently
- Offer desserts (especially cakes and cookies) less frequently, but offer low-fat, high-carbohydrate desserts (such as yogurt, pudding made from skim milk, and gelatin) more frequently

Schools coming close to the Dietary Guideline goal for total fat follow all or most of these practices consistently. Schools that offer higher-fat lunches follow only some of these practices, or follow them less frequently or less consistently.

**Schools that offer low-fat lunches (an average of less than 32 percent of food energy from fat) also provide an average of less than one-third of the RDA for food energy.** Both low-fat and higher-fat lunches meet the RDA standards for most vitamins and minerals. When they fall short, however, they do so in similar ways. School lunches that provide less than 32 percent of energy from fat provide somewhat less iron than do higher-fat lunches. In terms of the percentage of food energy from other macronutrients, low-fat lunches are relatively low in saturated fat and relatively high in carbohydrate, but contain almost the same amount of protein.

**NSLP participation does not vary with the average percentage of food energy from fat, except when the average is less than 32 percent.** NSLP participation rates in schools offering lunches with moderate levels of fat (32 percent to 35 percent of food energy) are the same as the rates in schools offering higher-fat lunches (more than 35 percent). However, the NSLP participation rate in schools that offer low-fat lunches (35 out of 545 schools) is 6 percentage points lower than the rate in schools offering lunches with an average of 32 percent to 35 percent of food energy from fat.

## THE SCHOOL BREAKFAST PROGRAM

**The SBP is available to slightly more than one-half of the nation's students, and just less than 20 percent of those to whom it is available participate.** Most students who do not eat an SBP breakfast obtain breakfast at home. Several groups are more likely than others to participate: students certified for free or reduced-price meals, students from low-income families, younger students, male students, African American students, and students in rural areas. More than 85 percent of SBP breakfasts are served to students whose family income is below 185 percent of the poverty level. During the 1991-1992 school year, the average full price for breakfast was \$0.60, and the average reduced price was \$0.28. Nearly all SBP breakfasts are provided free or at a reduced price.

**The availability of the SBP does not increase the likelihood that a student will eat breakfast.** On a typical school day, approximately 12 percent of students do not eat breakfast. This percentage is the same for students in schools that participate in the SBP and for those in schools that do not.

**Most SBP breakfasts are relatively simple, offering a small number of foods to satisfy the daily meal-pattern requirement.** Most SBP breakfasts offer relatively few choices from the bread/bread alternate category and only one choice from the fruit/vegetable/juice category. Almost one-half of SBP breakfasts offered do not include a meat or meat alternate. The milk options offered at breakfast are usually the same as those offered at lunch.

SBP breakfasts rely heavily on breads and ready-to-eat cereals. Juice is the most frequently offered food item in the fruit/vegetable/juice category. Citrus juice (almost always orange juice) is offered in 55 percent of all SBP breakfasts, and noncitrus juice is offered in 45 percent.

**SBP breakfasts provide one-fourth or more of the daily RDA for most nutrients, with the exception of food energy and zinc.** For male students older than 10 years of age, SBP breakfasts provide less than one-fourth of the RDA for food energy. For all age and gender groups, SBP breakfasts provide less than one-fourth of the RDA for zinc.

**SBP breakfasts are close to meeting the Dietary Guideline goal for total fat, but not those for saturated fat.** The average percentage of food energy from total fat is 31 percent, which is slightly higher than the Dietary Guideline goal of 30 percent or less. In contrast, the percentage of food energy from saturated fat is 14 percent, substantially higher than the goal of less than 10 percent. Moreover, although 44 percent of schools offer SBP breakfasts providing 30 percent or less of total food energy from fat, only 4 percent offer breakfasts providing less than 10 percent from saturated fat.

SBP breakfasts contain less fat than do NSLP lunches because schools are not required to serve a meat or meat alternate at breakfast. Almost one-half of the SBP breakfasts offered do not include a meat item. Breakfasts that do include a meat or meat alternate most frequently offer sausage, eggs, or cheese.

**SBP breakfasts meet the NRC recommendations for cholesterol and carbohydrate, but not the recommendation for sodium.** SBP breakfasts provide a mean of 73 mg of cholesterol, which is consistent with the breakfast goal of 75 mg or less. Carbohydrate provides 57 percent of the food energy of SBP breakfasts, compared with a goal of more than 55 percent. The mean amount of sodium is 673 mg, compared with a breakfast goal of 600 mg or less.

## DIETARY INTAKES OF NSLP PARTICIPANTS

**NSLP participants consume about one-third of the daily RDA for food energy and for most vitamins and minerals at lunch.** All NSLP participants obtain an average of one-third of the daily RDA for food energy, vitamin A, vitamin B6, iron, and zinc. The mean lunchtime intake of protein is nearly the total RDA, and the average intake of vitamin B12 is more than 100 percent of the RDA. NSLP participants' mean intakes at lunch of all other nutrients considered--vitamin C, thiamin, riboflavin, niacin, folate, calcium, phosphorus, and magnesium--are between 40 percent and 60 percent of the RDA.

In general, NSLP participants of different ages and both genders consume at least one-third of the RDA for most nutrients. However, adolescent female NSLP participants have lower average intakes relative to the RDA than do students in other age groups and consume less than one-third of the RDA for several nutrients. In particular, lunchtime intakes of vitamin A, vitamin B6, iron, magnesium, and zinc are less than one-third of the RDA for female NSLP participants 11 to 14 years old.

**NSLP participants consume more than the recommended amounts of fat, saturated fat, and sodium at lunch.** NSLP lunches *as offered* and *as consumed* contain very similar average amounts of fat and sodium. Fat provides 38 percent of the energy in lunches as offered, compared with 37 percent in lunches as consumed. Both lunches offered and lunches consumed provide approximately 1,500 mg of sodium. This finding, which indicates that students' food choices closely reflect foods offered, was not necessarily expected, given the wide variety of lunch choices available in most schools. Nutrients offered may be more or less than nutrients consumed, depending on what foods students select.

**The use of offers versus serve (OVS) in schools below the secondary level does not affect the nutrient intakes of NSLP participants.** The use of OVS slightly reduces a student's likelihood of selecting every meal component. Waste is somewhat lower in OVS schools, however, thereby offsetting the reduction in the proportion of students selecting each component. The net effect is that nutrient intake is the same in OVS and non-OVS schools. Students in OVS schools are less likely than students in non-OVS schools to select milk, but also are less likely to waste it. Overall, NSLP participants waste about 12 percent of the food energy in the food that they select.

**Over 24 hours, NSLP participants' average intakes of food energy, protein, and all vitamins and minerals exceed the RDA. Average intakes of fat and saturated fat exceed Dietary Guideline goals.** The average 24-hour intake of food energy is 115 percent of the RDA. NSLP participants consume approximately one-third of the RDA at lunch, as targeted, but consume more than two-thirds of the RDA at other times during the day. NSLP participants obtain 35 percent of their daily food energy from fat and 13 percent from saturated fat, compared with the Dietary Guideline goals of 30 percent or less and less than 10 percent, respectively. The average 24-hour intake of protein is more than twice the RDA.

## DIETARY INTAKES OF SBP PARTICIPANTS

**On average, students who eat an SBP breakfast consume an amount equivalent to one-fourth of the daily RDA for food energy and more than one-fourth for almost all vitamins and minerals.** Average intakes of all nutrients except food energy and zinc are well above the goal of one-fourth

of the RDA. The average intake of food energy is 26 percent of the RDA, and the average intake of zinc is 22 percent.

**SBP participants' intake of total fat at breakfast nearly meets the Dietary Guideline goal, but saturated fat intake is well above it. Breakfast intakes of cholesterol and sodium are higher than one-fourth of the maximum daily intakes recommended by the NRC.** SBP participants' breakfast intakes average 31 percent of food energy from fat, compared with the Dietary Guideline goal of 30 percent or less; 13 percent from saturated fat, compared with the Dietary Guideline goal of less than 10 percent; 97 mg of cholesterol, compared with the breakfast goal of 75 mg or less; and 840 mg of sodium, compared with the breakfast goal of 600 mg or less.

**SBP participants' average intakes over 24 hours of nearly all nutrients are greater than the RDA. Average 24-hour intakes of fat, saturated fat, cholesterol, and sodium exceed dietary recommendations.** SBP participants' average daily intake of food energy is 117 percent of the RDA. Only 26 percent of the RDA for food energy is consumed at breakfast, suggesting that SBP participants consume 91 percent of the RDA for food energy at other times during the day. Average intakes of all vitamins and minerals over 24 hours are also well above the RDA. Although breakfast intakes of fat are close to recommended levels, SBP participants consume proportionately more fat at other meals, thus raising the 24-hour percentage of food energy from fat to 36 percent.

## I. INTRODUCTION

Congress enacted the National School Lunch Act of 1946 to "safeguard the health and well-being of the Nation's children and to encourage the domestic consumption of nutritious agricultural commodities and other foods." To attain these goals, it authorized the National School Lunch Program (NSLP). In the Child Nutrition Act of 1966, Congress established the School Breakfast Program (SBP) as a pilot program to complement the NSLP. The 1975 amendments to the Child Nutrition Act authorized the SBP as a permanent program.

In 1979, the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) began a national evaluation of the School Lunch, School Breakfast, and Special Milk programs. The main component of this evaluation, which was conducted during the 1980-1981 school year, and which is known as the first National Evaluation of School Nutrition Programs (NESNP-I), yielded a wealth of information about the programs. Data were collected from students, parents, and food service administrators to support extensive analyses of a wide range of topics on the operation and effects of the school nutrition programs, including their dietary effects.<sup>1</sup> Since NESNP-I was conducted, there have been significant changes in the school nutrition programs, revisions in nutritional standards, and advances in understanding of the relationship between diet and health. Consequently, to improve the school nutrition programs, FNS needs current information on meals being offered in schools, on the dietary status of school children, and on the dietary effects of the programs.

Several ongoing nutrition monitoring efforts will generate information on how the eating and dietary intake patterns of broad population groups, including children, have changed during the last decade.<sup>2</sup> However, none of these broader efforts will support an in-depth assessment of the school

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<sup>1</sup>Volumes I and II of the final report by Wellisch et al. (1983) discuss the objectives, data, and results of NESNP-I in detail.

<sup>2</sup>Two surveys are particularly important: (1) the third National Health and Nutrition Examination Survey (NHANES-III), initiated in 1988 and scheduled to be completed in 1994; and (2) the (continued...)

nutrition programs. The School Nutrition Dietary Assessment study thus fills a critical gap in knowledge about the current effectiveness of a set of programs whose annual cost to the federal government was \$5.5 billion in fiscal year (FY) 1992.

The School Nutrition Dietary Assessment study has the following objectives:

- To describe the nutrient composition of NSLP and SBP meals *as offered* to students, and to examine the non-USDA meal alternatives available to students in school
- To analyze the *dietary intakes* of program participants
- To compare the dietary intakes of participants and nonparticipants

This report presents the findings of the School Nutrition Dietary Assessment study. The following sections of this introductory chapter describe the school nutrition programs, discuss the rationale for acquiring information on the nutritional quality of NSLP and SBP meals, and provide an overview of the report.

## A. THE SCHOOL NUTRITION PROGRAMS

The NSLP is the oldest and largest of the school nutrition programs. This program currently provides federal financial assistance and commodities to schools serving lunches that meet required nutritional standards.

In 1966, Congress established the SBP as a pilot program to provide funding for meals to children in "poor areas and areas where children had to travel a great distance to school." In 1975, amendments to the Child Nutrition Act authorized the SBP as a permanent program. Congress sought to make the program "available in all schools where it is needed to provide adequate nutrition for children in attendance." To expand the availability of the program, the 1989 Child Nutrition Act required that the Secretary of Agriculture award funds to states in order to support the costs of

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<sup>2</sup>(...continued)

Continuing Survey of Food Intake of Individuals (CSFII), which monitors trends in the food and nutrient intake of the population.

initiating breakfast programs in schools in which a large proportion of the student population comprises low-income children.

The NSLP and SBP are administered through the seven regional FNS offices, which also offer technical assistance to the states. State agencies (usually, but not always, state education agencies) administer the fiscal elements of the program, provide technical assistance to local School Food Authorities (SFAs), and monitor the performance of the SFAs. At the school-district level, the school board administers the program. A district SFA generally supervises the local schools that participate in the school nutrition programs. In many districts, the SFA also plans the menus and purchases the food, although responsibility for some or all planning and purchasing may be decentralized. Meals may be prepared by an individual school or by a central kitchen in the school district, which provides meals to satellite school buildings.

At the federal level, the USDA subsidizes, in the form of cash reimbursements and commodities, all school lunches and breakfasts served to children. The amount of the cash reimbursement varies according to the size and income level of the families of participating children. Children living in families whose family incomes are 130 percent or less of the poverty guidelines qualify for free meals; those living in families whose family incomes are between 130 percent and 185 percent of the guidelines qualify for reduced-price meals. All other children pay "full price" (although full-price lunches are also federally subsidized).

In FY 1993, the school lunch subsidy was \$0.1625 per meal for full-price lunches, \$1.2950 for reduced-price lunches, and \$1.6950 for free lunches. Schools with student populations that include a large proportion of needy individuals ("severe need" schools) receive additional assistance (\$0.02 per lunch). The comparable figures for the FY 1993 school breakfast subsidy are \$0.1875 for full-price breakfasts, \$0.6450 for reduced-price breakfasts, and \$0.9450 for free breakfasts. In severe-need schools, cash subsidies per breakfast are \$0.8225 for reduced-price breakfasts, and \$1.1225 for free breakfasts.

In addition to these cash reimbursements, all schools may receive entitlement commodities, valued at \$0.14 per lunch in FY 1993. All schools also have the option to receive bonus commodities. In FY 1993, schools were offered flour, butter, and cornmeal as bonus commodities.

All public or private, nonprofit elementary and secondary schools and residential institutions for children are eligible to participate in these school nutrition programs. According to administrative data from the USDA, in October 1992, the NSLP operated in about 95 percent of all schools and residential institutions (92,946 schools and institutions) and was available to 42.7 million children. In FY 1992, average daily participation in the NSLP was 24.6 million students, or 58 percent of children who had access to the NSLP. According to the data, in October 1992, the SBP operated in about 54 percent of all schools and residential institutions (54,818) and was available to 24.6 million school children; 20 percent (4.9 million) participated. In 1992, the federal cost of the NSLP (cash and commodities) was estimated at \$4.7 billion, and that of the SBP was estimated at \$786 million.

## **B. CURRENT PROGRAM ISSUES**

Two sets of issues prompted the USDA to undertake the new study of the school nutrition programs: (1) changes in dietary standards; and (2) changes in program regulations.

### **1. Changes in Dietary Standards**

Before the 1980s, dietary recommendations focused on ensuring that the amounts and variety of foods consumed were adequate to provide the levels of nutrients and food energy necessary for good health. The Food and Nutrition Board of the National Academy of Sciences sets Recommended Dietary Allowances (RDA) for each nutrient, which is a daily amount that is adequate to meet the needs of nearly all healthy individuals. The Food and Nutrition Board revises the RDA periodically, as new data become available. For example, the RDA for zinc and folate were

established for the first time in 1980. The latest revision, published in 1989, changed the values for several nutrients for various age and gender groups.

The RDA have long formed the basis for menu planning in the school nutrition programs. Indeed, USDA regulations require that NSLP lunches provide, over time, one-third of the RDA for all nutrients. The goal of the SBP, although not specified as a program requirement in the regulations, is to provide one-fourth of the RDA.

During the last 15 years, advances in understanding of the relationship between diet and the risk of chronic disease have prompted concerns about the overconsumption of some dietary components. Several federal, professional, and health organizations have published dietary recommendations based on this understanding. In 1980, the USDA and U.S. Department of Health and Human Services (DHHS) issued *The Dietary Guidelines for Americans*. The Dietary Guidelines were revised in 1985 and were reissued in November 1990. As discussed more fully in Chapter II, they recommend, among other changes, reducing the intake of fat and saturated fat, and moderating the intake of sodium and dietary cholesterol.

In September 1990, DHHS published *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. One objective [2.17] pertains specifically to the school nutrition programs: "Increase to at least 90 percent the proportion of school lunch and breakfast services and child care food services with menus that are consistent with the nutrition principles in the Dietary Guidelines for Americans." The School Nutrition Dietary Assessment study will provide the baseline data and methodology for analyzing menus that must be developed in order to meet this objective by the year 2000.

Although current regulations governing the NSLP and SBP do not include provisions specifically implementing the Dietary Guidelines, the USDA is committed to implementing the Dietary Guidelines in school meal programs by the year 2000.

## **2. Changes in School Nutrition Program Regulations**

Several regulatory and programmatic changes in the 1980s have affected how the school nutrition programs operate. These changes, which could affect the nutritional quality of meals provided to children in school and the dietary effects of those programs, include (1) changes in the NSLP and SBP meal-pattern requirements, (2) the extension of offer versus serve (OVS) in the NSLP to more grade levels and to the SBP, (3) changes in the rules governing foods that compete with NSLP meals (competitive foods), and (4) changes in the availability and use of agricultural commodities.

### **a. Meal-Pattern Requirements**

Meal-pattern requirements for NSLP lunches are set such that, over time, the lunches provide approximately one-third of the daily RDA for specific nutrients. The lunch meal must include five items: a serving of meat or meat alternate; two or more servings of vegetables and/or fruits; whole-grain or enriched bread or bread alternate; and milk. Minimum quantities of each meal component are specified for students of different age and grade groups. Secondary school students may refuse as many as two items under OVS (which is discussed in the next subsection), and regulations permit SFAs to offer this option to students below the secondary level. At all levels, many schools offer students a range of choices within each meal component at lunch.

SBP breakfasts are expected to provide approximately one-fourth of the RDA for important nutrients. Program regulations specify that each reimbursable school breakfast must include a serving of fluid milk, a serving of fruit or vegetable or a full-strength fruit or vegetable juice, and two servings of either bread or meat or their alternates.

Since 1980, the USDA has revised the meal-pattern requirements for federally supported school breakfasts and school lunches. Rules finalized in May 1986 allow such commodities as nuts and seeds to be credited toward the meat component. Several provisions of the School Lunch and Child Nutrition Amendments of 1986 changed the nutrient content of meals offered: (1) whole milk must be offered as a beverage (reversing a policy that allowed schools to serve only lower-fat milk);

(2) an iron-rich food item was added to the school breakfast requirement in order to increase the iron content of the breakfast by 4.6 mg per week; and (3) a second serving of bread or meat, or bread or meat alternate, was added as a breakfast requirement.

**b. Extending the Availability of OVS**

Congress has responded to criticism that food was being wasted in school. Beginning in the 1970s, Congress permitted high school children to refuse as many as two of the five items offered as part of the federally supported lunch (the "offer versus serve" option). Subsequent legislation allowed local authorities to institute the OVS option at the elementary level. Beginning with the 1989-1990 school year, OVS was also extended to the SBP. Some nutritionists and health professionals have argued that, by enabling students to regularly refuse the same two items, such as milk and vegetables, this program option might compromise the nutritional quality of school meals.

**c. The Availability of Competitive Foods**

In 1970, Congress authorized the USDA to regulate the sale in schools of foods that compete with the lunch offered under the National School Lunch Act and the Child Nutrition Act. Initially, USDA regulations limited the food items sold in schools to those that either contributed to one of the required meal components or that were served as an additional item with the school meal. However, in 1972, Congress amended the USDA authority over competitive foods by exempting from restriction the sale of any food the proceeds of which accrued to the school or to school organizations. In 1977, Congress modified this exemption by authorizing that the USDA establish regulations approving the foods that could be sold in school in competition with the meal program. However, by the mid-1980s, judgments resulting from lawsuits forced the USDA to reconsider its regulations on competitive foods and to loosen the restrictions on what foods could be sold. Thus, USDA meals must now compete with a range of other foods that are available to students both within and outside the schools, including foods from vending machines.

#### **d. The Use of Agricultural Commodities**

From its inception, the NSLP has distributed agricultural commodities to schools.<sup>3</sup> The availability of surplus commodities is erratic, because it depends largely on regulatory changes in farm programs, and on weather conditions. The USDA specifies the form in which commodities arrive at schools, as well as the standards for their content. For instance, recently, it has reduced the sodium level for canned vegetables,<sup>4</sup> and the sugar level for canned fruits. It has also allowed school districts to establish agreements with companies to process the raw (or near-raw) commodities into value-added foods, such as pizzas, baked goods, and portion-controlled beef patties.

### **C. OBJECTIVES AND OVERVIEW OF THE REPORT**

Given the policy concerns outlined in the preceding sections, FNS specified that the School Nutrition Dietary Assessment study address three key sets of questions:

- What is the nutrient content of USDA meals *as offered* to children in schools?
  - How do USDA-reimbursable breakfast and lunch meals compare with dietary standards defined on the basis of the RDA and goals of the *Dietary Guidelines for Americans*?
  - What meal-preparation factors affect the nutrient content of USDA meals as offered, especially the proportion of food energy from fat?
  - What non-USDA meal alternatives are available to students?

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<sup>3</sup>Three sources of commodities are used in the school nutrition programs: (1) Section 32 entitlement commodity purchases required by law; (2) Section 32 emergency surplus purchases; and (3) Section 416 Surplus Commodity Credit Corporation commodities. The latter two categories are considered "bonus" commodities, the type and quantity of which can vary. A portion of Section 32 funds (of P.L. 74-320), an amount equal to 30 percent of annual U.S. customs receipts (\$400 million in FY 1989) is earmarked for purchasing perishable commodities for schools. In addition to entitlement commodities, school nutrition programs may receive bonus commodities through the Commodity Credit Corporation price support activities or Section 32 emergency surplus removal purchases. The Secretary of Agriculture has the discretion to use Section 32 funds (up to \$262 million available at the end of FY 1991) to purchase commodities and to distribute them to a variety of outlets, including schools.

- What are the *nutrient intakes* of program participants?
  - What are the nutrient contents of USDA-reimbursable meals and non-USDA meals *as consumed*?
  - How do the meal-specific and total 24-hour nutrient intakes of NSLP and SBP participants compare with dietary standards defined on the basis of the RDA and goals of the Dietary Guidelines?
  - Does the contribution of the NSLP and SBP programs vary with family income?
  - Does the use of OVS affect the selection of particular meal components, the amount of each component wasted, or the nutrient intakes of program participants?
- What are the dietary effects of the NSLP and SBP?
  - How do the meal-specific and 24-hour intakes of participants compare with those of nonparticipants?
  - Do the effects of the program vary by age or gender or by family income?
  - How do foods consumed by participants compare with those consumed by nonparticipants?

In addition to these primary objectives, the study also describes the operations of the NSLP and SBP at the local level.

The detailed findings of the School Nutrition Dietary Assessment study are presented in three reports. After providing an overview of the study design and describing the nutritional standards used to assess the nutrient content of meals offered and students' nutrient intakes, this report (1) presents background information about the operation of the NSLP and SBP, (2) describes the nutrient content of NSLP lunches as offered, (3) analyzes the meal-preparation factors that differentiate the lunches offered at schools in which the percentage of food energy from fat meets dietary recommendations from the lunches offered in other schools, (4) describes the nutrient content of SBP breakfasts as offered, (5) describes participants in the NSLP and SBP and identifies factors that appear to promote or inhibit participation, and (6) describes the meal-specific and 24-hour nutrient intakes of NSLP and SBP participants and compares these intakes with appropriate standards. Appendices to this report

describe the methodology used to analyze the nutrient content of meals as offered, present additional information pertaining to the analysis of participation, and present additional information on NSLP lunches offered and SBP breakfasts offered.

A second report (Devaney et al. 1993) examines the nutrient intakes and eating patterns of all students and compares the intakes of NSLP and SBP participants with the intakes of students who eat meals obtained from other sources. The third report (Burghardt, Ensor, et al. 1993) describes data collection operations for the various facets of the School Nutrition Dietary Assessment study and the selection of the sample of school districts, schools, and students who participated in it.

In addition, a brief summary report (Burghardt and Devaney 1993) presents the study's main findings.

## II. OVERVIEW OF THE STUDY DESIGN

This chapter describes key features of the research design that was used to address the study questions and presents background information for interpreting the findings presented in subsequent chapters. Section A discusses the nutrients that are analyzed and the standards used to assess the nutrient content of meals offered and students' nutrient intakes. Section B describes the sample design and sources of data. Section C briefly describes two central analytical issues that affect how the results should be interpreted.

### A. KEY NUTRIENTS AND DIETARY STANDARDS

The various components of this study examine a common set of nutrients and food components and apply a common set of standards to gauge dietary quality.

#### 1. Nutrients Included in the Analysis

The 1986 report of the Joint Nutrition Monitoring Evaluation Committee (JNMEC) of the U.S. Department of Health and Human Services and the U.S. Department of Agriculture (USDA) identified eight food components that warrant priority status in public health monitoring because they are underconsumed or overconsumed by the U.S. population as a whole, or by subgroups of the population: *food energy, total fat, saturated fatty acids, cholesterol, sodium, vitamin C, calcium, and iron*. The JNMEC also recommended that several other nutrients be monitored, despite the lack of evidence on the extent of their deficient or excess consumption: *protein, vitamin A, thiamin, riboflavin, niacin, total carbohydrate, vitamin B12, and phosphorus*. In addition, the JNMEC suggested that additional information be obtained on the intake of *dietary fiber, added sweeteners, vitamin B6, magnesium, folate, and zinc*. This report presents study data on all of these dietary components, with the exception of added sweeteners. Added sweeteners are not considered because the nutrient

database used did not allow the contributions of complex carbohydrate and of sugar to total carbohydrate to be analyzed separately.

## **2. Defining Dietary Assessment Standards**

For purposes of assessing the amounts of nutrients and other dietary components in the meals offered to students, as well as the amounts that the students consumed, the study drew on three sources: (1) the Recommended Dietary Allowances (RDA); (2) the *Dietary Guidelines for Americans*; and (3) recommendations presented in *Diet and Health*, by the National Research Council (NRC) (National Research Council 1989a). School nutrition program meals are planned to ensure that they meet nutrient standards based on the RDA. In addition, the Food and Nutrition Service encourages school food service programs to consider the *Dietary Guidelines for Americans* when planning meals, although no regulations or quantitative guidelines for achieving this general goal have been instituted. Because no quantitative measures for achieving some of the Dietary Guidelines are available, NRC recommendations are used in the study as reference standards for assessing sodium, cholesterol, and carbohydrate. However, it should be noted that the USDA has not incorporated the NRC recommendations into its program guidance.

### **a. Recommended Dietary Allowances**

RDA, which are expressed as average daily intakes over a period of time, have long provided the standards used to assess nutrient adequacy among population groups. Indeed, National School Lunch Program (NSLP) lunches are planned to provide students with one-third of the RDA, and School Breakfast Program (SBP) breakfasts are planned to provide one-fourth of the RDA.

The RDA Subcommittee on the Tenth Edition of the RDAs of the Food and Nutrition Board of the NRC sets the RDA (National Research Council 1989b). It uses the following criterion to establish the RDA for individual nutrients. The RDA are:

The levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons.

Individual requirements for any given nutrient vary widely according to many factors that differ from nutrient to nutrient. Scientists distinguish between the requirements necessary to maintain an adequate reserve of nutrients within the body and the levels necessary to avoid the onset of disease. RDA are generally set to maintain adequate body reserves. The RDA subcommittee also emphasizes that, for many nutrients, scientific knowledge about the distribution of nutrient requirements among individuals is very limited; thus, for each nutrient, the committee sets age- and gender-specific average daily requirements for a reference person of a given weight and height, using the best available scientific data and the committee's professional judgment. Conceptually, if the distribution of nutrient requirements among individuals were a normal (bell-shaped) distribution, the RDA would be set at two standard deviations above the mean requirement for the population. This conceptualization is useful primarily as an analogy, because the distribution of requirements for many nutrients is not symmetric (bell-shaped), and because the distribution of requirements for some nutrients is not well known.

The RDA subcommittee uses a different approach to establish the RDA for food energy. The committee sets the RDA for food energy for individuals of different age and gender groups according to its estimate of the *average* energy needs of that population group, rather than at an amount sufficient to meet the needs of *most individuals*. If the committee were to set the requirements at an amount adequate to meet the needs of most individuals, as it does with the other nutrients, many individuals with lower energy needs might be at risk of overconsumption. Thus, it is desirable that a large proportion of the population consume at least the RDA for other nutrients, but that about one-half of the population consume at least the RDA for food energy, and that average food energy intake be approximately equal to the RDA. If more than one-half of a population group is consuming more than the RDA for food energy, the group may be at risk of

overconsumption; if less than one-half is consuming more than the RDA for food energy, some group members may be obtaining insufficient food energy.

Conventionally, nutrient adequacy is assessed by comparing the nutrient intake of a research sample with the RDA, using either the group mean relative to the RDA or the proportion of the sample that falls below some threshold percentage of the RDA as an indicator of the likely prevalence of nutrient adequacy. However, a serious and widely recognized shortcoming of this approach is that intakes below the RDA, even substantially below, do not necessarily indicate inadequate nutrition, or even an increased risk of inadequacy, because the RDA are defined such that average intake levels below them may be adequate (National Research Council 1986).

Despite these limitations, the RDA remain an important set of standards for assessing nutrient adequacy of population groups. Indeed, as noted previously, regulations are designed so that lunches reimbursed under the NSLP provide one-third of the RDA over time. In addition, the RDA are widely used standards in studies of nutritional status, and their use in this report will facilitate comparisons with other studies. Accordingly, intakes of the following nutrients are compared with their respective age- and gender-specific RDA: protein, vitamin A, vitamin C, thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, calcium, iron, phosphorus, magnesium, zinc, and total energy.

**b. Reference Standards from the Dietary Guidelines and Recommendations of the NRC**

The RDA standards used in the school nutrition programs do not address current concerns about the consumption of fat, sodium, or cholesterol. However, the *Dietary Guidelines for Americans* and recommendations of the NRC in *Diet and Health* (1989) provide reference standards for assessing the intake of these dietary components.

The Dietary Guidelines offer advice about healthy eating to all Americans 2 years of age and older. As shown in Table II.1, the Dietary Guidelines are presented in the form of food guides and offer general recommendations. They also recommend specifically that no more than 30 percent of

TABLE II.1  
DIETARY GUIDELINES FOR AMERICANS

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- Eat a variety of foods
  - Maintain healthy weight
  - Choose a diet low in fat, saturated fat, and cholesterol
  - Choose a diet with plenty of vegetables, fruits, and grain products
  - Use sugars only in moderation
  - Use salt and sodium only in moderation
  - If you drink alcoholic beverages, do so in moderation
- 

SOURCE: *Dietary Guidelines for Americans*, 1990.

total food energy be derived from fat, and that less than 10 percent be derived from saturated fat. However, they do not provide specific quantitative targets for the other general recommendations.

The NRC offers quantitative measures of several other Dietary Guideline goals in *Diet and Health* (1989). It recommends that individuals limit their daily intake of sodium chloride to 6 grams (2,400 mg of sodium) and limit their daily intake of cholesterol to 300 mg. It also recommends that individuals increase their intake of carbohydrate to more than 55 percent of total food energy by choosing a diet high in fruits, vegetables, and grains. Finally, the NRC recommends a moderate protein intake, which it defines as no more than twice the RDA. These recommendations of the Dietary Guidelines and the NRC are used as reference standards in this report. Table II.2 summarizes the standards used in this report to assess dietary intakes and meals as offered.

## **B. SAMPLE DESIGN AND DATA COLLECTION**

The School Nutrition Dietary Assessment study draws on information from two units of analysis: (1) schools; and (2) students.<sup>1</sup> Altogether, 545 schools participated in the study. Analysis of the *nutrient content of meals as they are offered* is based on information provided by school food service personnel from a nationally representative sample of 544 schools. The information consists of descriptions of foods and the amounts of foods offered as part of NSLP lunches and SBP breakfasts during a one-week period, which have been converted into estimates of the average nutrients offered per meal. Analysis of the *dietary intake of students* is based on information provided during in-person dietary intake interviews by a nationally representative sample of 3,350 students in grades 1 through 12 in 329 of the schools in the national sample.<sup>2</sup> The information consists of descriptions of all

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<sup>1</sup>Data collection and sample design for the study and the results of data collection are described more fully in the companion report by Burghardt, Ensor, et al. (1993).

<sup>2</sup>The 329 schools are a nationally representative subset of the 544 schools in which school-level data were collected. As a result of cost or other considerations, the student sample excludes the following groups: students not attending school on the day of the interview, students enrolled in programs offering self-contained classes for students with disabilities, students from Alaska or Hawaii, and students enrolled in kindergarten or other pre-first grade classes. See Burghardt, Ensor, et al. (1993).

TABLE II.2

## QUANTITATIVE STANDARDS USED TO ASSESS DIETARY INTAKES

Dietary Component	Standard of Comparison	Source
Food Energy, Protein, Vitamin A, Vitamin C, Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Calcium, Iron, Phosphorus, Magnesium, Zinc	24-hour intakes compared with the RDA	National Research Council, <i>Recommended Dietary Allowances</i> , 10th Edition
	Lunch intake compared with one-third of the RDA	USDA requirement for NSLP lunch
	Breakfast intake compared with one-fourth of the RDA	USDA planning goals for SBP breakfast
Total Fat	30 percent or less of total food energy	<i>Dietary Guidelines for Americans</i>
Saturated Fat	Less than 10 percent of total food energy	<i>Dietary Guidelines for Americans</i>
Carbohydrate	More than 55 percent of total food energy	National Research Council, <i>Diet and Health</i>
Sodium	Total sodium intake of 2,400 mg or less per day (800 mg per lunch and 600 mg per breakfast)	National Research Council, <i>Diet and Health</i>
Dietary Cholesterol	Total intake of dietary cholesterol of 300 mg or less per day (100 mg per lunch and 75 mg per breakfast)	National Research Council, <i>Diet and Health</i>
Protein	Total protein intake of no more than twice the RDA	National Research Council, <i>Diet and Health</i>

RDA = Recommended Dietary Allowances.

USDA = U.S. Department of Agriculture.

NSLP = National School Lunch Program.

SBP = School Breakfast Program.

mg = milligrams.

foods and beverages consumed by each student during a specific 24-hour period that included a school day. An analysis of the *factors that condition the nutrient content of meals as offered and the nutrient content of meals as consumed* is based on information provided by school administrative staff and School Food Authority (SFA) staff. Staff from all 545 schools provided descriptive information on school enrollment levels, school nutrition-program participation rates, and the characteristics of meal services.<sup>3</sup> At the 329 schools selected for in-person interviews, this information was supplemented with observational information on foods offered in the schools a la carte or in vending machines.

## **1. School-Level Data**

Three types of information were collected for the school-level study component on nutrient content: (1) information on all foods and beverages offered as part of an NSLP or SBP meal during a one-week period; (2) information on the characteristics of schools and their meal services; and (3) information on alternative sources of food.

### **a. Meals Offered**

The data on meals offered include data on all foods offered as part of an NSLP lunch or SBP breakfast during a specific one-week period from January to May 1992.<sup>4</sup> Materials were mailed to designated school food service personnel in the participating schools, requesting that they provide information on all foods offered as part of an NSLP lunch or SBP breakfast on each day during the target week. The request covered foods that count toward satisfying a meal-pattern requirement, as well as foods that do not count toward the meal-pattern requirement. Food service staff were asked

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<sup>3</sup>One school slated for in-person data collection provided data on school enrollments, program participation, and meal service, but did not complete meals offered information or student dietary intake interviews.

<sup>4</sup>At schools in which student-level data were gathered from in-person dietary intake interviews, the target week for collecting information on meals offered coincided with the week in which the interviews were administered.

to provide menus; the recipes for food items prepared in the school district; manufacturers' labels, nutrient analysis, or product specifications of food items purchased from vendors; and details on food-preparation procedures and portion sizes for all items.

At the 329 schools selected for in-person dietary intake interviews, the data collectors assembled the information provided by food service personnel and examined it for completeness while on site. If necessary, they clarified the information with the food service staff. At the 215 schools selected for school-level data collection only, study staff telephoned the food service staff member shortly after the data request was mailed in order to explain the request and to answer any questions. The study staff then made follow-up calls, as necessary, to remind respondents to return the material within the specified period. The assembled information was coded by the Nutrition Coordinating Center at The University of Minnesota, to generate estimates of the nutrients contained in the foods offered as part of NSLP and SBP meals.<sup>5</sup>

#### **b. School and Meal-Service Characteristics**

Basic descriptive information on student enrollment level, nutrition-program participation rates, and meal-service characteristics were collected from the principal, cafeteria manager, and director of the local SFA. This information describes key features of meal services and is used to identify factors that may influence student participation in the programs. It was collected from all 545 schools. For schools targeted for in-person student interviews, the information from school staff usually was collected by telephone prior to the visit by the data collection team. Occasionally, it was collected in person, during the visit. For schools selected for the school-level study component only, study project staff administered the interviews by telephone prior to mailing out the data request on USDA reimbursable meals to food service personnel.

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<sup>5</sup>Data were collected for all schools offering a lunch or breakfast program, including 20 schools that do not participate in the USDA programs. The data from these schools have not been tabulated, given the very small sample providing non-USDA meals.

### **c. Information on Alternative Sources of Food in School**

Information was collected on two sources of food offered as alternatives to NSLP lunches: (1) foods sold a la carte in the cafeteria at lunch; and (2) foods available to students from vending machines throughout the school day. These data were collected only at the 329 schools slated for the in-person interviews. The data collection team gathered this information on the day of the school visit, using checklists to record which of several categories of food and beverage items were offered a la carte or in vending machines on that day. Although these data provide estimates of the proportion of schools nationwide offering various types of foods from these two alternative sources, this study did not analyze the nutrient content of a la carte and vending machine foods. Data on meals offered and school characteristics were available for approximately 80 percent of the schools selected for the study.

## **2. Student-Level Data**

Data for the student-level dietary intake study component were collected from approximately 10 students in each of the 329 schools. Three types of data were collected:

- Information on dietary intake
- Information on the student's personal and family characteristics, and on his or her perception of the school nutrition programs
- Information on whether the student was certified as eligible for free or reduced-price school meals

The methods used to collect the information varied according to the grade of the student.

*Students in the 3rd through 12th grades* were administered a three-part, in-person interview during the school day. The interview consisted of:

- A 24-hour dietary recall that elicited descriptions and estimated quantities of all foods and beverages consumed during the preceding 24 hours, as well as the location of the eating occasion and, for foods eaten in school, the source of the food

- For foods eaten in school, questions about foods that the student may have selected or been served but did not consume completely, in order to determine participation rates in the USDA meal program, and to estimate the plate waste of meals served in school
- Questions to elicit perceptions about the USDA meal programs and information about the student's age and family characteristics (household size and whether the child resides with his or her mother)
- Observation and coding by interviewers of students' race and gender

A short questionnaire was mailed to the parents of the students who completed the in-person interview. The parent questionnaire requested that the parents furnish information on family income, household size, the ethnicity of the student, and the parent's knowledge and perceptions of the USDA meal programs. If the questionnaire was not returned within two weeks after the completion date of the dietary intake interview, study staff attempted to complete the mail questionnaire by telephone, if the parent was willing.

*Students in the 1st and 2nd grades* are generally less able than older students to recall the foods that they eat during a 24-hour period, to describe the foods precisely, and to estimate accurately the amount of food consumed. In general, researchers have found that dietary recalls conducted jointly with parents and children elicit the most accurate dietary intake information for children in this younger age group. However, in this study, the students themselves were deemed the best source of information on the foods that they ate in school on the day of the interview, with more accurate information on food waste elicited if the child's parent were not present. Therefore, the study design included a *brief* interview during the school day with each 1st- and 2nd-grade sample member. The students were asked to report only the foods and beverages that they had consumed in school during the day on which the interview was conducted. The interviewers requested a description of each food reported, and the estimated quantity of that item consumed. The children were also asked to estimate the amount that they may have selected or been served, but did not eat.

An interview was then conducted later that day with the child and with his or her parent or guardian. This interview requested dietary intake information on all foods eaten during the

immediately preceding 24 hours, excluding the period covered by the previous interview with the student. At the conclusion of the child-parent interview, the parent was asked to furnish several items of information about the student and his or her household--income, whether the child's mother (or mother figure) lived in the home, whether the mother worked outside the home, and the ethnicity of the student--as well as opinions about the school nutrition program. Basically, the parent or guardian was asked to provide all of the same types of information as was requested on the questionnaire eliciting personal and family characteristics from the students in grades 3 through 12.

Overall, 85 percent of schools selected for in-person data collection with students participated in the study.<sup>6</sup> At these schools, completed dietary intake interviews were obtained from 75 percent of selected students. Thus, the cumulative student response rate was 64 percent.

Finally, school officials or cafeteria personnel were asked to provide information on the meal-price eligibility status (free, reduced price, or full price) of all members of the student sample. Meal-price eligibility status was obtained for approximately 90 percent of the students who completed a 24-hour dietary recall interview.

### **C. ANALYTICAL ISSUES**

This section presents a brief discussion of three issues that influence interpretation of the study findings: (1) measurement errors; (2) use of the RDA; and (3) interpretation of the individual-intake data.

#### **1. Possible Measurement Error in the Individual-Intake Data**

As noted in Section B, data on the dietary intakes of students are derived from reports provided by the students themselves for students in grades 3 through 12, and from reports provided by students and parents for students in grades 1 and 2. Using structured probes, interviewers asked sample members to list all foods and beverages consumed, to describe each item as fully as possible, and to

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<sup>6</sup>Detailed information on completion rates for the various study components is presented in Chapter III of Burghardt, Ensor, et al. (1993).

estimate the amount of each item consumed. Trained nutritionists then used carefully developed procedures and special computer software in order to convert these descriptions into estimates of nutrients consumed.

Individual-intake data that are based on 24-hour recalls by study subjects are subject to measurement error that can result from the inability of respondents to recall all foods eaten, to describe foods accurately, or to estimate the quantity consumed. Care was taken to train the interviewers for this study, and to edit the acquired data for completeness and accuracy. Furthermore, the same protocols were used to acquire and code the data provided by both program participants and nonparticipants. However, it is likely that the data contain some degree of recall error, although the degree of error is expected to be the same among NSLP and SBP participants as it is among students who acquired breakfast and lunch from other sources.

## **2. Use of the RDA**

As noted in Section A, separate RDA are set for various age and gender groups, on the basis of the differing requirements of persons in each age group. Specifically, the NRC sets separate RDA for children aged 4 to 6 years, children aged 7 to 10 years, males aged 11 to 14 years, females aged 11 to 14 years, males aged 15 to 18 years, and females aged 15 to 18 years. Although a single value is given for each group for each nutrient, requirements change such that the average requirements of, say, 11-year-old males very likely differ from those of 14-year-old males. To account for within-group differences, consideration was given to interpolating the requirements for each group so as to recognize explicitly that the requirements of an 11-year-old male are more similar to those of a 10-year-old male than to those of a 14-year-old male. In the end, however, a decision was made to use the RDA as specified for each age group, rather than interpolating the values to derive more age-appropriate values. Two considerations led to this decision. First, the actual RDA are the targets used in planning USDA meals. Second, because intake estimates based on 24-hour recalls contain

some measurement error, refining the estimates of individual requirements may result in a misleading level of precision.

### **3. Interpretation of the Meal-Specific and 24-Hour Intakes**

For most dietary components, the analytical objective is to determine whether usual intake is above or below a threshold level. For vitamins and minerals, the objective is to determine whether the usual intake exceeds the threshold. For total fat, saturated fat, sodium, and cholesterol, the objective is to determine whether the usual intake is below a maximum amount. Food energy is an exception, because the objective is to determine whether intakes are distributed around the RDA, with some individuals above the RDA, and some below it.

In assessing the data from this study according to the various standards of dietary quality, two interpretive limitations must be recognized. First, the RDA for most dietary components are set whereby the recommended amount will be sufficient to meet the needs of most healthy individuals. However, nutritional requirements of individuals vary greatly, and many persons may remain perfectly healthy even if the amount of a nutrient consumed is much less than the RDA. Thus, with the exception of food energy, a usual intake substantially below the RDA does not necessarily signal a nutrient deficiency. The RDA for food energy are set to reflect the average energy needs of the population. Thus, it must be determined whether the average energy intake among the sample diverges significantly from the average needs as reflected in the RDA.

Second, although most standards of dietary adequacy are defined in terms of *usual intake*, available dietary intake data of individual students were taken from *a single week day* on which the student attended school. The intake of particular nutrients by an individual may vary considerably from one day to the next--being high one day, and low another--and still constitute an adequate intake over a period of time. Furthermore, intakes on school days may differ from intakes on weekends or on week days when the student does not attend school.

Recognizing these limitations of measures based on 24-hour recalls, the study presents data on the group's *average* intake for each dietary component (that is, the mean value of intake, and the mean of the intake relative to the RDA for the person's age and gender), as well as measures that reflect the *distribution* of intake among individuals (that is, the percentage of the population that is above the RDA or below the Dietary Guideline goals and NRC recommendations). All of these measures are reported in the appendices, although the discussion focuses on a limited group of measures for each nutrient. For all measures, the reader should bear in mind that intakes only on week days on which a student attends school are represented in the study.

In comparing the intake of *groups*, discussion usually focuses on the group mean and its relationship to the RDA. It is very important to bear in mind that *group means below an RDA target do not necessarily indicate that the intakes of group members are inadequate*. Low group-mean intakes merely signify that some members of the group *may be* at greater risk of deficiency. The inherent analytical shortcoming is that the differences in risk of deficiency cannot be precisely or reliably quantified.